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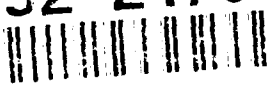
Report to the Chairman, Subcommittee on Defense, Committee on Appropriations, House of Representatives



GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-248483

July 30, 1992

The Honorable John P. Murtha
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

The Air Force and the Navy combined have requested over $900 million for fiscal year 1993 for improvements to and continued procurement of the Advanced Medium Range Air-to-Air Missile (AMRAAM). You asked us to review and report on (1) the requirements, cost, and schedule for the improvements and (2) the current production status of the missile. As you requested, we provided a letter on May 1, 1992, with information on AMRAAM's production status to support deliberations on the fiscal year 1993 budget request.[1] A copy of that letter is included as appendix I.

Results in Brief

The Air Force and the Navy consider AMRAAM critical to the air superiority capabilities of their current and future fighter force. The services have a three-phased program to reduce AMRAAM's size and improve the missile's effectiveness against current and future threat aircraft. The improvement program, which began in fiscal year 1990, is estimated to cost about $446 million through fiscal year 1999. Because of questions about AMRAAM's lethality, the Air Force reevaluated the missile's performance against current threat aircraft, and in April 1992, the Defense Acquisition Board directed the Air Force to accelerate lethality improvements.

Under current production and improvement plans, about 6,600 missiles, or about 43 percent, of the 15,450 AMRAAMs to be procured will have the warhead improvements that are needed to counter the threat aircraft for AMRAAM in the mid-1990s and beyond. However, because the accelerated schedule for the lethality improvements makes the effort a medium- to high-risk program, there is a good possibility that the program may slip,

[1]Letter to the Chairmen, House Committee on Armed Services and Subcommittee on Defense, House Committee on Appropriations (GAO/NSIAD-92-212R, May 1, 1992).

which would result in fewer improved missiles. Officials with the Air Combat Command,[2] which represents Air Force operational units that would use the missile in combat, said that the warhead improvements are needed in as many AMRAAMs as possible and that the number of improved AMRAAMs could be increased by retrofitting the missiles with the new warhead.

In our May 1992 letter, we estimated that, based on the projected delivery schedules for missiles to be procured with fiscal year 1993 funds, funds for 581 missiles will not be needed in fiscal year 1993. Delaying the procurement of these missiles until the lethality improvements are developed and incorporated in the production lines would result in more improved missiles. Moreover, limiting future procurements until the lethality improvements are incorporated in production missiles would result in more improved missiles, without the need for retrofitting.

Background

The Air Force and the Navy consider AMRAAM a high priority tactical missile that is critical to their efforts to upgrade the air superiority capabilities of their current and future fighter force. The services developed AMRAAM to be compatible with their latest fighter aircraft: the Air Force's F-15 and F-16 and the Navy's F-14 and F/A-18. It is also to be compatible with the Air Force's future advanced fighter, the F-22.

The Air Force manages the AMRAAM program from a Joint System Program Office at Eglin Air Force Base, Florida. Both the Air Force and the Navy are procuring AMRAAMs from Hughes Aircraft Company and Raytheon Company.

Air Force officials began to define AMRAAM improvements in the mid-1980s, near the end of the missile's full-scale development. The Defense Acquisition Board authorized an AMRAAM preplanned product improvement program following its review of the missile in June 1987. The program is to develop and test changes to AMRAAM that will improve the missile's (1) capabilities to counter advances in threat aircraft and their missiles that have occurred since the AMRAAM program began in 1979 and

[2]At the time of our review, the officials were with the Tactical Air Command. However, on June 1, 1992, the Tactical Air Command, most of the Strategic Air Command, and a small portion of the Military Airlift Command were combined into the Air Combat Command.

(2) compatibility with the Air Force's F-22 aircraft. The Air Force has requested $35.4 million for the improvement program for fiscal year 1993.

The Congress has appropriated over $4.4 billion through fiscal year 1992 to procure over 4,000 AMRAAMs in the first 6 production years. Hughes and Raytheon are under contract to produce 2,253 and 1,857 AMRAAMs, respectively. For fiscal year 1993, the Air Force has requested $731.4 million for 1,015 missiles, and the Navy has requested $137.5 million for 140 missiles. The Air Force and the Navy plan to procure 15,450 missiles through fiscal year 2000. The total procurement cost is estimated at about $12.2 billion, including inflation.

Over the last few years, we have reported on issues about AMRAAM.[3] In June 1991, we reported that the AMRAAM contractors continued to experience problems in meeting production schedules and that a substantial production backlog existed. In our May 1992 letter on AMRAAM's production status, we concluded that both contractors had increased their monthly production quantities to about 30 missiles per month but had fallen short of the quantities projected at the time of our June 1991 report. As a result, the production backlog had increased. Moreover, the Air Force had renegotiated the contractors' delivery schedules in October 1991 to provide for more moderate increases in monthly production quantities. On the basis of the projected delivery schedules for missiles to be procured with fiscal year 1993 funds, we estimated that funds for 581 missiles will not be needed in fiscal year 1993.

Requirements, Cost, and Schedule for the Improvements

The AMRAAM preplanned product improvement program is a multiyear program estimated to cost about $446 million through fiscal year 1999.

AMRAAM Improvements

The Air Force plans to improve AMRAAM in four principal areas:[4] missile size, electronic counter countermeasures (ECCM), lethality, and propulsion.

[3]Missile Procurement: AMRAAM's Reliability Is Improving, but Production Challenges Remain (GAO/NSIAD-91-209, June 20, 1991) and Missile Procurement: Further Production of AMRAAM Should Not Be Approved Until Questions Are Resolved (GAO/NSIAD-90-146, May 4, 1990).

[4]A fifth improvement, field reprogrammability, would allow technicians to reprogram the missile's software without disassembling the missile. The work on this improvement has been included in the AMRAAM producibility enhancement program.

The change in missile size is designed to improve the missile's compatibility with the F-22. The Air Force wants to reduce AMRAAM's wing span by clipping its wings and fins so that more AMRAAMs can be carried internally on the F-22 aircraft.

The other changes are designed to improve the missile's performance against advances in the threat. The ECCM improvements are to enable AMRAAM to find, track, and destroy enemy targets despite advances in enemy electronic countermeasures. Countermeasures such as radar jamming interfere with a missile's ability to find and track a target. The improvements are to include hardware and software changes to AMRAAM's guidance section. The lethality improvements are designed to increase AMRAAM's probability of destroying enemy aircraft, which are becoming harder to kill. The lethality improvements are focused on changes to AMRAAM's warhead, fuze, and target detection device. The propulsion improvements are under review by the Air Force and the Navy. Specific joint requirements have not been determined. The AMRAAM propulsion improvements are focused on a new motor.

Cost and Schedule

The Air Force has divided the research and development improvement program into three phases. The phases are based on a joint Air Force and Navy determination of the users' needs to meet the threat, the affordability of the improvements based on projected budgetary constraints, and the maturity of the technology.

The first phase, estimated to cost about $197 million, is scheduled from fiscal year 1990 through 1995. This phase focuses on some ECCM improvements and the reduction in the missile's wing span. The Air Force plans to incorporate these improvements in AMRAAM lot 8, with production starting in fiscal year 1996. Phase 1 also includes studies to determine whether additional hardware changes will be needed to accommodate future ECCM improvements and to explore advanced propulsion technology.

Phase 2 will concentrate primarily on improvements to the warhead, fuze, and target detection device to improve the missile's lethality. Phase 2 is also to develop more ECCM software improvements. This phase was estimated to cost about $170 million and was scheduled from fiscal year 1994 through 1998. Under this schedule, the lethality and ECCM improvements were to be incorporated in lot 12, with production starting in fiscal year 2001.

On April 30, 1992, the Defense Acquisition Board directed the Air Force to accelerate the phase 2 lethality and ECCM efforts. Under the accelerated program, the Air Force plans to incorporate the lethality and ECCM improvements late in lot 10, with production scheduled to start in fiscal year 1998. Under this schedule, the improvements are to be incorporated in production missiles 2 years earlier than the previous schedule and, according to Air Force estimates, in about 6,600 missiles, or 43 percent of the total AMRAAMs to be procured. The Air Force transferred $400,000 within the improvement program for fiscal year 1992 to start the accelerated effort.

Phase 3 is to begin in fiscal year 1995 and extend through 2003. Costs have only been estimated through 1999 and total about $79 million. This phase will focus on propulsion development efforts and examine the need for more ECCM. Phase 3 improvements are to be incorporated in lot 14, AMRAAM's last lot, with production starting in fiscal year 2003.

Air Force Options for Accelerating Lethality Improvements

Over the past several years, tests have been conducted to assess the lethality of AMRAAM's warhead. In March 1991, the Office of the Secretary of Defense's Deputy Director, Operational Test and Evaluation, concluded that testing did not clearly show that the lethality of AMRAAM's warhead was acceptable. In May 1991, the Defense Acquisition Board reviewed the AMRAAM program and directed the Air Force to evaluate, among other things, the need for improvements to AMRAAM's lethality against advanced threats and changes in the improvement program.

The evaluation focused primarily on AMRAAM's performance against the aircraft that are projected to be the most widely deployed in the mid-1990s and beyond. The results of the evaluation are classified. Nevertheless, the evaluation identified two options for improving AMRAAM's lethality.

One option was to provide an interim improvement to AMRAAM's warhead based on current technology. The second option was to accelerate the current warhead development program, based on advanced technology, and incorporate the lethality improvements earlier in the production program. The Air Force recommended the second option to the Defense Acquisition Board because it would cost less and include the full lethality improvements in more missiles. In April 1992, the Board concurred with the Air Force's recommendation. The Air Force recognized that accelerating the lethality effort will involve a medium to high degree of risk because of the shorter warhead development schedule.

Air Combat Command officials said that the enhanced lethality improvements should be incorporated into as many AMRAAMs as possible. They said that this could be accomplished by retrofitting the improved warhead into lot 6 and subsequent production missiles. Production plans for lot 6 missiles include changes to AMRAAM that would allow technicians to reprogram the missile's software without disassembling the missile. The officials stated that the Command may recommend the retrofitting of these missiles if the warhead development effort succeeds. The Air Force estimates retrofitting costs to be about $51,000 per missile.

Department of Defense and Air Force officials stated that there are issues associated with retrofitting missiles with a new warhead. For example, the missiles with live warheads have to be shipped to the contractors so the old warheads can be removed and the new warheads installed. Shipping the missiles with live warheads presents logistical problems. Moreover, working with the missiles always raises the risk that the warhead work could cause other problems with the missiles. The missiles with the new warheads would have to be tested, and if problems were uncovered during the testing, the missiles would have to be reworked.

Procurement Options for Increasing Number of Improved Missiles

AMRAAM procurement plans are inconsistent with threat projections for the mid-1990s and the Air Combat Command's position that the lethality improvements should be incorporated into as many missiles as possible. Based on the Air Force's accelerated improvement schedule, about 6,600 missiles, or about 43 percent of the total AMRAAM procurement, will include the lethality improvements.

The Air Force and the Navy plan to increase procurement quantities over the next several years to the levels shown in table 1.

able 1: Planned AMRAAM Procurement uantities

Production lot	Procurement year	Quantities		
		Air Force	Navy	Total
7	1993	1,015	140	1,155
8	1994	1,015	225	1,240
9	1995	1,168	225	1,393
10	1996	960	240	1,200
11	1997	1,200	295	1,495
12	1998	1,100	850	1,950
13	1999	1,100	873	1,973
14	2000	1,045	0	1,045
Total		**8,603**	**2,848**	**11,451**

There are options available to increase the number of AMRAAMs with the improved warhead without the need for retrofitting. Our May 1992 letter said that funds for 581 AMRAAMs for lot 7 will not be needed in fiscal year 1993. Delaying procurement of these missiles until after the improved warhead is developed and incorporated into production would increase the number of improved missiles and save up to $30 million in retrofitting costs. Similarly, delaying the procurement of some missiles for lots 8, 9, and if needed, 10 until after the improved warhead is developed and incorporated into production would ensure that more missiles are available to meet the threat and the Air Combat Command's needs without the need for retrofitting.

According to Air Force officials, the minimum monthly production rate needed to sustain each contractor's operations is about 30 missiles. The minimum sustaining rate is the least number of items that can be produced on a single shift basis and still avoid increasing the unit cost by 20 percent. Therefore, yearly procurement of about 720 missiles would keep the contractors' production lines operating without substantially increasing AMRAAM's unit cost. By limiting lots 8 and 9 to 720 missiles, the Air Force could delay procurement of 1,193 missiles and save up to $60 million in retrofitting costs. Similarly, limiting lot 10 production until the improvements are incorporated in the production lines could save more retrofitting costs.

Department of Defense and Air Force officials stated that potential savings through competition may be lost if the total procurement quantities for lots 7, 8, and 9 are reduced to 720 missiles or less because each contractor would probably be awarded an equal share of the lots. They said that there is no guarantee that savings can be achieved in future years but that the

estimated savings from the lot 6 competition was about 12 percent of the air vehicle recurring costs, or $13 million. Lot 6 procurement was for 891 missiles: 401 missiles for Hughes and 490 missiles for Raytheon.

Recommendation

Because of the issues and cost associated with retrofitting AMRAAMs with the new warhead and the uncertain financial benefit of competition, we recommend that the Secretary of Defense direct the Secretaries of the Air Force and the Navy to reduce AMRAAM future procurements to the minimum production rates needed to sustain contractor operations until the lethality improvements are incorporated in the missile.

Matter for Congressional Consideration

The Congress should deny funds for 581 missiles for fiscal year 1993 because (1) the missiles are scheduled to be delivered beyond that fiscal year's funded delivery period and (2) delaying procurement of these missiles until after lethality improvements can be incorporated in the production line would ensure that more missiles are produced with the improvements. As stated in our May 1, 1992, letter, this would amount to a reduction of approximately $250 million.

Agency Comments

As you requested, we did not obtain written agency comments from the Department of Defense. However, we held an exit conference with officials directly involved in the program to discuss a draft of this report. We have incorporated their comments where appropriate throughout the report.

We describe our scope and methodology in appendix II.

As arranged with your office, we are sending copies of this report to appropriate congressional committees; the Secretaries of Defense, the Air Force, and the Navy; the Director, Office of Management and Budget; and other interested parties. We also will make copies available to others upon request.

Please contact me at (202) 275-4268 if you or your staff have any questions concerning this report. Other major contributors to this report are listed in appendix III.

Sincerely yours,

Nancy R. Kingsbury
Director
Air Force Issues

Interim Information on AMRAAM's Production Status

GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-248483

May 1, 1992

The Honorable Les Aspin
Chairman, Committee on
Armed Services
House of Representatives

The Honorable John P. Murtha
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

Over the last few years, we have reported on issues pertaining to the Air Force's Advanced Medium Range Air-to-Air Missile (AMRAAM).[1] In June 1991, we reported on the status of production. We are reviewing the contractors' current status of missile production as part of our work on the AMRAAM Preplanned Product Improvement Program and plan to issue a report later this year. This letter is in response to your staffs' requests that we provide interim information on AMRAAM's production status to support deliberations on the fiscal year 1993 budget request.

BACKGROUND

The Air Force and the Navy jointly developed the AMRAAM and both services are procuring the missile. The Air Force manages the program.

The Congress has appropriated over $4.4 billion through fiscal year 1992 to procure over 4,000 AMRAAMs in the first 6 production years. Hughes Aircraft Company and Raytheon Company are under contract to produce these missiles, as shown in table 1.

[1]Missile Procurement: AMRAAM's Reliability Is Improving, but Production Challenges Remain (GAO/NSIAD-91-209, June 20, 1991) and Missile Procurement: Further Production of AMRAAM Should Not Be Approved Until Questions Are Resolved (GAO/NSIAD-90-146, May 4, 1990).

Table 1: AMRAAMs Under Contract

Production lot	Fiscal year	Quantity under contract Hughes	Raytheon
1	1987	105	75
2	1988	223	200
3	1989	534	372
4	1990	450	450
5	1991	540	270
6	1992	401	490
		2,253	1,857

The Air Force's and the Navy's budget requests for fiscal year 1993 include $868.9 million for 1,155 missiles. Specifically, the Air Force has requested $731.4 million for 1,015 missiles, and the Navy has requested $137.5 million for 140 missiles.

RESULTS IN BRIEF

Since our June 1991 report, both contractors have increased their monthly production quantities but have fallen short of the quantities projected at that time. As a result, the production backlog has increased. Moreover, the Air Force has renegotiated the contractors' delivery schedules to provide for a more moderate increase in monthly production quantities. Furthermore, on the basis of the projected delivery schedule for missiles to be procured with fiscal year 1993 funds, we estimate that funds for 581 missiles will not be needed in fiscal year 1993.

OPTIMISTIC PRODUCTION ESTIMATES

We stated in our June 1991 report that Hughes had delivered 30 missiles a month during the first 4 months of 1991 and that the modified contracts required Hughes to deliver 45 missiles in May 1991 and each month thereafter. Hughes averaged about 29 missiles a month from May 1991 through March 1992 and increased its missile deliveries to 35 missiles during February and March 1992.

We reported in June 1991 that Raytheon had delivered 9 missiles a month during the first 4 months of 1991 and that the modified contracts required Raytheon to deliver 32 missiles in May 1991, 38 missiles in August 1991, and 46 missiles a month thereafter. Raytheon delivered 12 missiles in May 1991 and 18 missiles in August 1991. It averaged about 27 missiles a month from September 1991 through March

1992. Raytheon had increased deliveries to 31 and 32 missiles during February and March 1992, respectively.

At the time of our prior review, Hughes and Raytheon were scheduled to complete lot 3 deliveries in March and April 1992, respectively. However, the Air Force renegotiated the contractors' delivery schedules in October 1991 because of production delays. Hughes and Raytheon are scheduled to complete lot 3 deliveries in September and November 1992, respectively.

INCREASED PRODUCTION BACKLOG

We stated in our June 1991 report that through April 1991 Hughes had delivered only 314 of the 701 missiles planned to be delivered when the contracts for the first 3 production lots were awarded. The production backlog was 387 missiles. Through March 1992, Hughes had delivered 629 of 1,160 missiles planned when the contracts for the first 4 production lots were awarded. The production backlog grew to 531 missiles.

In our June 1991 report, we said that through April 1991 Raytheon had delivered only 138 of the 551 missiles planned to be delivered when the contracts for the first 3 production lots were awarded. The production backlog was 413 missiles. Through March 1992, Raytheon had delivered 385 of 945 missiles planned when the contracts for the first 4 production lots were awarded. The production backlog grew to 560 missiles.

REQUEST FOR FUNDS BEYOND
THE FUNDED DELIVERY PERIOD

Defense budget guidance specifies that the services' annual procurement budget requests should fund no more than the quantities to be delivered in the 12-month period following the lead time needed to negotiate and award a contract and procure raw materials and components. This 12-month period is referred to as the funded delivery period.

Historically, the lead time estimated in AMRAAM budget documents for lots 2 and beyond was 21 months. Considering the lead time, AMRAAM's funded delivery period for fiscal year 1993 is June 1994 through May 1995. Budget documents supporting the fiscal year 1993 Air Force and Navy budget requests show that 581 (510 Air Force and 71 Navy) of the 1,155 missiles are expected to be delivered between June 1995 and November 1995--the 6 months following the funded

delivery period. Therefore, in accordance with Defense budget guidance, funding for the 581 missiles will not be needed in fiscal year 1993.

Our June 1991 report concluded that funding for 314 AMRAAMs requested for fiscal year 1992 was not needed because the missiles were scheduled to be delivered beyond that fiscal year's funded delivery period. The Department of Defense estimated funding for the 314 missiles at $137 million or approximately $436,000 per missile. Although we recognize that the cost per missile may vary somewhat from year to year, the 581 missile reduction for fiscal year 1993 would amount to approximately $250 million.

We discussed the information presented in this letter with Air Force headquarters officials responsible for the AMRAAM program. The officials said that the cut in missiles was neither prudent nor warranted. According to the officials, many if not all of AMRAAM's previous technology and production issues have been eliminated. Moreover, the contractors have met or exceeded the delivery schedules that were renegotiated in October 1991. Also, according to the officials, the proposed reduction would significantly impact the source selection process because 1,014 missiles are necessary for a competitive split between the contractors. Furthermore, the officials stated that this letter does not recognize the administrative lead time to negotiate and award the contracts which is in addition to the 21-month manufacturing lead time needed by the contractors to order and assemble parts. According to the officials, the administrative lead time for lot 7 missiles, which is estimated at 4 to 5 months, is needed because congressional enactment of the authorization and appropriation bills has traditionally been late and contracting cannot be completed until congressional funding action is known. Therefore, according to the officials, all of the missiles requested for fiscal year 1993 are within that year's funded delivery period.

At the time of our June 1991 report, we were told that the contractors' production schedules were achievable because technology and production issues had been resolved. However, the contractors continued to fall far short of production schedules during the subsequent months. Although the contractors have met the more moderate schedules which were renegotiated in October 1991, they have not shown that they can consistently deliver missiles at increasing rates. The statement that 1,014 missiles is necessary for a competitive split between contractors is not supported by

the fact that lots 5 and 6 were competitively awarded for 810 and 891 missiles, respectively.

The budget documents supporting lot 1 production show a 6-month administrative lead time in addition to the 21-month manufacturing lead time, but the documents also show that the administrative time is only required for that initial production lot. Budget documents for lots 4 and 5 do not show administrative lead time, but the documents for lots 6 and 7 reintroduce the need for the additional lead time. This appears to be contrary to budget guidance which indicates that the lead time should decrease for follow-on production lots.

The actual lead time has increased over the years as production delays have occurred and the missile backlog grew. For example, the lead time to Hughes' first missile delivery increased from 27 months for lot 1 to 31 months for lot 3 and the lead time to Raytheon's first missile delivery increased from 27 months to 35 months for lot 3. Hughes and Raytheon are projected to deliver their first lot 4 missiles after lead times of 35 and 33 months, respectively.

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We conducted our review from November 1991 through April 1992 in accordance with generally accepted government auditing standards. If you have questions, please call me or Mr. Robert L. Pelletier, Assistant Director, of my staff at (202) 275-4268.

Nancy R. Kingsbury
Director
Air Force Issues

(392715)

GAO/NSIAD-92-212R Missile Procurement

Scope and Methodology

To determine the status of the AMRAAM preplanned product improvement program, we reviewed pertinent program documents, plans, cost estimates, budget support data, and program and production schedules at the AMRAAM Joint System Program Office, Eglin Air Force Base, Florida, and at Air Force Headquarters, Washington, D.C. We discussed the improvement program with Air Force officials at the program office, Air Force Headquarters, and the Air Combat Command, Langley Air Force Base, Virginia. We also discussed questions about AMRAAM's lethality with officials of the Office of the Director, Live Fire Test, Office of the Secretary of Defense.

We visited Hughes' production facility in Tucson, Arizona, and Raytheon's production facility in Bedford, Massachusetts, to determine the current status of production and the reasons for production delays since our June 1991 report.

We performed our work from November 1991 through May 1992 in accordance with generally accepted government auditing standards.

Major Contributors to This Report

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